

American and Canadian veterinarians' perceptions on dog and cat core vaccination rates and the impact of the human medicine anti-vaxx movement on veterinary medicine

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Abstract — An electronic survey was distributed to assess American and Canadian veterinarians' perceptions on dog and cat vaccination rates. The top veterinarian concerns for vaccinating a healthy adult dog were anaphylaxis, soreness at the injection site, and lethargy; for cats, these concerns included vaccine-associated sarcoma, lethargy, and soreness at injection site. Veterinarians reported that the most common concerns mentioned by reluctant or resistant clients to vaccinating their dogs or cats were beliefs that vaccinations are costly and unnecessary or may lead to chronic or severe illness. There was a positive correlation between an organized anti-vaxx movement against mandatory vaccination for children in their community and the number of vaccine resistant or concerned clients. That the number of resistant clients was associated with the presence of an organized anti-vaxx movement implies that the human anti-vaxx movement is impacting pet owners' views on companion animal vaccinations.

Résumé — Perceptions des vétérinaires américains et canadiens sur les taux de vaccination de base des chiens et des chats et impact du mouvement anti-vaxx en médecine humaine sur la médecine vétérinaire. Un sondage électronique a été distribué pour évaluer les perceptions des vétérinaires américains et canadiens sur les taux de vaccination des chiens et des chats. Les principales préoccupations des vétérinaires pour la vaccination d'un chien adulte en bonne santé étaient l'anaphylaxie, la douleur au site d'injection et la léthargie; pour les chats, ces préoccupations comprenaient le sarcome associé au vaccin, la léthargie et la douleur au site d'injection. Les vétérinaires ont signalé que les préoccupations les plus courantes mentionnées par les clients réticents ou résistants à la vaccination de leurs chiens ou chats étaient la croyance que les vaccinations sont coûteuses et inutiles ou peuvent entraîner une maladie chronique ou grave. Il y avait une corrélation positive entre un mouvement anti-vaxx organisé contre la vaccination obligatoire des enfants de leur communauté et le nombre de clients inquiets ou résistants à la vaccination. Le fait que le nombre de clients résistants soit corrélé à la présence d'un mouvement anti-vaxx organisé suggère que le mouvement anti-vaxx en médecine humaine a un impact sur l'opinion des propriétaires d'animaux de compagnie sur la vaccination des animaux de compagnie.

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Introduction

Vaccines are viewed by many as one of the great achievements of medical science because they have eradicated or drastically reduced the incidence of what once were common diseases in both humans and animals (1). Vaccines work at both an individual and community level. In addition to individual immunity against a disease, “herd immunity” can be achieved when a high enough proportion of the population is vaccinated, thus reducing the risk of an outbreak because of the small num-

ber of unvaccinated humans or animals by which the disease can spread. The proportion of immune individuals in a given population against a specific pathogen that must be vaccinated to achieve herd immunity depends on several factors, including the infectiousness of the disease. For canine distemper, for example, this proportion is estimated to be 70% (2).

Until recently, the primary barrier to immunization was inadequate supply (at least in some parts of the world), but in recent years there has been a rise in “vaccine hesitancy,” defined

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as a delay in acceptance or refusal to vaccinate despite availability (1). Attitudes to vaccines can be viewed on a continuum, rather than a dichotomy, ranging from total acceptance to complete refusal. Those who are reluctant or hesitant to vaccinate are a heterogeneous group somewhere in the middle of the continuum. These individuals are uncertain about vaccines but may still support some types of vaccinations and should be differentiated from anti-vaxxers who are a small yet vocal group of outright vaccine rejecters who oppose the use of vaccines in all forms (3). Anti-vaxxers have the power to influence vaccination rates by spreading misinformation to the much larger population of vaccine-hesitant individuals (1).

Vaccine hesitancy is quickly becoming a significant health threat and was identified as one of the top 10 global health threats of 2019 (4). When exploring reluctance to vaccinate children, those who are resistant or hesitant in high-income countries often cite concerns about safety, a fear used by anti-vaxxers to build opposition to vaccinations (5). Although most members of the scientific community agree that vaccines are safe and effective, safety concerns exist primarily because of the Internet. Social media is one of the most common ways in which people access false information about vaccine safety (6). Most people now have access to the Internet and use it to not only find health-related information, but to create and share their own content (7). Messages about vaccines on social media predominantly focus on negative experiences because these are easier to visualize than the benefits of vaccines — the absence of disease. This has the result of increasing mistrust of vaccines and vaccine hesitancy (6,8,9).

For companion animals, the “core” diseases for which vaccines are recommended include canine distemper, canine parvovirus, infectious canine hepatitis, and rabies (10). The core vaccines for cats include those for feline (panleukopenia) parvovirus, feline calicivirus, feline herpes virus-1, and rabies (11). Similar to human health, dog and cat vaccines are seen as one of the safest and most cost-effective means of preventing infectious diseases (12).

There has been increasing concern by veterinarians worldwide that vaccine compliance rates are decreasing. It was noted in the 2018 People’s Dispensary for Sick Animals Animal Wellbeing report (13) that only 72% of dog owners and 61% of cat owners reported that their pet had received primary vaccinations; down from 88% for dogs and 74% for cats in 2016. The number of owners who report giving their pets regular booster vaccinations had also decreased during this time (78% for dogs and 59% for cats). The primary reasons given by dog owners for not vaccinating their pet include feeling it wasn’t necessary (20%), too expensive (19%), and had not thought about it (11%). The cat owners who did not vaccinate their pet reported that it was too expensive (21%), that the cat did not come into contact with other animals (19%), and that vaccines were not necessary (18%) (13).

Although anecdotal stories suggest that the anti-vaxx movement has negatively impacted companion animal vaccination compliance rates, there has been no research exploring this connection. This study was designed to examine and compare veterinarians’ concerns about vaccinating healthy dogs and

cats with the concerns expressed by their clients, as well as the possible relationship between a local anti-vaxx movement and perceived trends in vaccination compliance rates.

Materials and methods

An anonymous online survey was created in collaboration with Veterinary Information Network (VIN), an online veterinary community, to evaluate US and Canadian veterinarians’ views on rabies and other core vaccinations. Since rabies vaccines are mandated by law in many areas, we separated rabies vaccines from the other core vaccines for dogs and cats. The legal requirement for a rabies vaccine, along with the human health implications of rabies, might influence owners to vaccinate their dogs and cats against rabies more so than against other core infectious agents. For the purposes of clarity, vaccines are referred to as rabies and other core vaccines. The survey was created and tested by researchers at Colorado State University and VIN and piloted by a small sample of veterinarians for appropriate branching and question flow, ambiguity, and potentially missing or inappropriate response options. Feedback from these veterinarians was incorporated into the final version of the survey. A link to the survey was distributed *via* an e-mail invitation to all VIN members ($N \sim 35\,000$), and access was made available from January 5, 2020 through February 4, 2020. A follow-up message was sent 2 wk after the initial invitation. Only data from those who live in the US and Canada and work in a veterinary practice where they routinely vaccinate client-owned dogs or cats were included in the study. The study was categorized as exempt by Colorado State University’s Institutional Review Board. Because this was an anonymous survey, written informed consent was not required. An introductory statement explained the study and indicated to potential participants that consent was implied by completing the survey.

The survey was administered directly *via* the VIN data collection portal, and branching logic was used to display only questions relevant to each participant. The body of the survey consisted primarily of short questions, for which participants were able to select 1 or more specific options to represent their experiences and perceptions on core and rabies vaccinations. Free-text boxes were provided for participants to enter brief alternative answers when none of the listed options applied to them. A final question at the end of the survey allowed for free-text entry of any comments participants chose to make about the impact of the anti-vaxx movement in human health on veterinary preventative health. Descriptive statistics pertaining to participant demographics and perceptions, in addition to Chi-square, were used to analyze the results. Statistical significance was set at $P < 0.05$. Open text questions were categorized, and the most common responses were reported.

Results

A total of 2385 respondents indicated they routinely vaccinate dogs and/or cats. This sample consisted of 1971 (82.6%) from the US, 290 (12.2%) from Canada, 9 (0.4%) from the UK, 64 (2.7%) from Australia, and 51 (2.1%) from other countries. Because the laws pertaining to vaccinations differ across the world and the number of respondents from countries other

Table 1. Clients' level of concern with potential issues that may arise when vaccinating a healthy adult dog that has no prior vaccination history.

	Never/rarely	Sometimes	Often/very often
Pain on injection (<i>n</i> = 1915)	1494 (78.0%)	365 (19.1%)	56 (2.9%)
Bleeding from injection site (<i>n</i> = 1914)	1890 (98.7%)	19 (1.0%)	5 (0.3%)
Lethargy for several days after vaccination (<i>n</i> = 1916)	970 (50.6%)	815 (42.5%)	131 (6.8%)
Inappetence for several days after vaccination (<i>n</i> = 1914)	1334 (69.7%)	517 (27.0%)	63 (3.3%)
Soreness at injection site for several days (<i>n</i> = 1911)	1063 (55.6%)	725 (37.9%)	123 (6.4%)
Abscess formation at injection site (<i>n</i> = 1914)	1873 (97.9%)	37 (1.9%)	4 (0.2%)
Anaphylaxis (<i>n</i> = 1913)	1221 (63.8%)	536 (28.0%)	156 (8.2%)
Vaccine-associated sarcoma (<i>n</i> = 1917)	1664 (86.8%)	209 (10.9%)	44 (2.3%)
Cost (<i>n</i> = 1914)	719 (37.6%)	752 (39.3%)	443 (23.1%)
A belief that vaccinations are unnecessary (<i>n</i> = 1918)	292 (15.2%)	779 (40.6%)	847 (44.2%)
A belief that vaccinations can lead to chronic or severe illness (<i>n</i> = 1917)	566 (29.5%)	691 (36.0%)	660 (34.4%)
Religious or philosophical beliefs (<i>n</i> = 1909)	1606 (84.1%)	218 (11.4%)	85 (4.5%)
Political objections (being required to vaccinate against rabies) (<i>n</i> = 1906)	1642 (86.1%)	203 (10.7%)	61 (3.2%)
Dog never goes outside, so never exposed (<i>n</i> = 1906)	352 (18.5%)	720 (37.8%)	833 (43.7%)

Table 2. Clients' level of concern with potential issues that may arise when vaccinating a healthy adult cat that has no prior vaccination history.

	Never/rarely	Sometimes	Often/very often
Pain on injection (<i>n</i> = 1922)	1440 (74.9%)	421 (21.9%)	61 (3.2%)
Bleeding from injection site (<i>n</i> = 1927)	1895 (98.3%)	29 (1.5%)	3 (0.2%)
Lethargy for several days after vaccination (<i>n</i> = 1929)	1062 (55.1%)	753 (39.0%)	114 (5.9%)
Inappetence for several days after vaccination (<i>n</i> = 1930)	1255 (65.0%)	587 (30.4%)	88 (4.6%)
Soreness at injection site for several days (<i>n</i> = 1931)	1308 (67.7%)	551 (28.5%)	72 (3.7%)
Abscess formation at injection site (<i>n</i> = 1929)	1875 (97.2%)	46 (2.4%)	8 (0.4%)
Anaphylaxis (<i>n</i> = 1924)	1517 (78.8%)	328 (17.0%)	79 (4.1%)
Vaccine-associated sarcoma (<i>n</i> = 1931)	1048 (54.3%)	692 (35.8%)	191 (9.9%)
Cost (<i>n</i> = 1928)	763 (39.6%)	705 (36.6%)	460 (23.9%)
A belief that vaccinations are unnecessary (<i>n</i> = 1933)	269 (13.9%)	689 (35.6%)	975 (50.4%)
A belief that vaccinations can lead to chronic or severe illness (<i>n</i> = 1927)	718 (27.3%)	657 (34.1%)	552 (28.6%)
Religious or philosophical beliefs (<i>n</i> = 1920)	1645 (85.7%)	196 (10.2%)	79 (4.1%)
Political objections (being required to vaccinate against rabies) (<i>n</i> = 1921)	1594 (83.0%)	227 (11.8%)	100 (5.2%)
Cat never goes outside, so never exposed (<i>n</i> = 1923)	63 (3.3%)	369 (19.2%)	1491 (77.5%)

than the US and Canada were too few to analyze separately, only responses from veterinarians in the US and Canada are described, for a total sample size of 2261.

Respondents from the US came from all 50 states and the District of Columbia, with most residing in California (*n* = 211; 10.7%), Texas (*n* = 139; 7.1%), Pennsylvania (*n* = 120; 6.1%), Florida (*n* = 116; 5.9%), Massachusetts (*n* = 94; 4.8%), and Illinois (*n* = 75; 3.8%). Most respondents from Canada resided in Ontario (*n* = 147; 50.7%) or British Columbia (*n* = 58; 20.0%).

When asked for the year of graduation from veterinary school (*N* = 2261), 132 (5.8%) respondents reported between 1950 and 1979; 465 (20.6%) between 1980 and 1989; 540 (23.9%) between 1990 and 1999; 558 (24.7%) between 2000 and 2009; and 566 (25.0%) between 2010 and 2019. Almost all respondents indicated that they routinely vaccinate dogs (2211/2261 (97.8%)) and cats (2243/2261 (99.2%)).

Most respondents indicated that they live in areas where rabies vaccines are mandated (*N* = 2261) for both dogs and cats (*n* = 1669; 73.8%), followed by dogs only (*n* = 390; 17.2%), differs by region (*n* = 50; 2.2%), not mandated (*n* = 141; 6.2%), and don't know (*n* = 11; 0.5%). When comparing the US (*N* = 1971) with Canada (*N* = 290), the US had higher levels of mandatory rabies vaccinations for dogs and cats (*n* = 1517; 77.0%), compared to Canada (*n* = 152; 52.4%). An additional

379 (19.2%) US respondents reported mandatory rabies vaccination for dogs only, compared to 11 (3.8%) respondents from Canada. Although only 23 (1.2%) US respondents said rabies vaccination was not required, 118 (40.7%) respondents from Canada reported no requirement. Vaccination requirements for the US and Canada were significantly different ($\chi^2 = 700.31$, *df* = 4, *P* < 0.001). Only those who reported routinely vaccinating dogs or cats were included in further analyses.

Despite the differences in requirements pertaining to mandatory rabies vaccinations, there were no differences between responses from the US and Canada to the questions pertaining to beliefs about whether dogs and cats should be vaccinated regularly (not necessarily annually) with other core and rabies vaccines. Most respondents agreed that dogs should receive other core (*n* = 2084; 94.4%) and rabies vaccines (*n* = 2147; 97.3%) and cats should receive other core (*n* = 2047; 91.3%) and rabies vaccines (*n* = 2108; 94.3%).

Respondents were asked to indicate their level of concern with several potential issues that may arise when vaccinating a healthy adult dog with no prior vaccination history. This question was designed to assess concerns about vaccination reactions in general and not specific to a dog with known reactions. The top concerns (some; quite a bit) for veterinarians included anaphylaxis (some *n* = 821, 37.2%; quite a bit *n* = 171, 7.8%), soreness at injection site for several days (some *n* = 883, 40.1%,

quite a bit $n = 38$; 1.7%), and lethargy for several days after vaccination (some $n = 827$, 37.5%; quite a bit $n = 46$, 2.1%). Respondents could also write in additional concerns with the concerns listed most frequently including immune stimulation ($n = 107$), allergic reaction ($n = 47$), and owners' booster compliance ($n = 44$).

Respondents were then asked to indicate their concern level with several potential issues that may arise when vaccinating a healthy adult cat with no prior vaccination history. This question was designed to assess concerns about vaccination reactions in general and not specific to a cat with known reactions. The top concerns (some; quite a bit) were vaccine-associated sarcoma (some $n = 1217$, 54.5%; quite a bit $n = 288$, 12.9%), lethargy for several days after vaccination (some $n = 940$, 42.1%; quite a bit $n = 60$, 2.7%), and soreness at injection site for several days (some $n = 771$, 34.6%; quite a bit $n = 50$, 2.2%). Respondents could also write in additional concerns and those listed most frequently included risk for disease ($n = 50$), immune stimulation ($n = 43$) and concern about owners' booster compliance ($n = 31$). In addition to their own concerns, veterinarians were asked to indicate, from a given list, how frequently dog owners who are hesitant or resistant to vaccines mentioned specific concerns. These results are presented in Table 1. The most common concerns mentioned by vaccine hesitant or resistant dog owning clients included beliefs that vaccinations are unnecessary, they can lead to chronic or severe illness, and cost.

Participants were also asked to indicate, from a given list, how frequently vaccine hesitant or resistant cat owners mentioned specific concerns (Table 2). Similar to dog owners, the most commonly cited reasons included beliefs that vaccinations are unnecessary, that they can lead to chronic or severe illness, and cost.

The next part of the survey asked respondents if they had clients who had expressed concern or refused to vaccinate their dog or cat for rabies or other core vaccines within the last 3 y. Most respondents reported yes, they did have clients who expressed concerns or refused rabies vaccination in dogs ($n = 1543$, 77.93%) and other core vaccines ($n = 1942$, 91.5%). These responses were increased ($n = 570$, 37.1%), stayed the same ($n = 929$, 60.5%), or decreased ($n = 36$, 2.3%) for rabies vaccine and were increased ($n = 862$, 44.7%), stayed the same ($n = 1008$, 52.3%) or decreased ($n = 58$ (3.0%)) for other core vaccines. Similarly, most respondents reported yes, they had clients who expressed concerns or refused rabies vaccinations in cats ($n = 1705$, 84.9%) and other core vaccines ($n = 1959$, 90.9%). These responses were increased ($n = 608$, 35.9%), stayed the same ($n = 1050$, 62.0%), or decreased ($n = 36$, 2.1%) for rabies vaccine and were increased ($n = 788$, 40.5%), stayed the same ($n = 1117$, 57.4%), or decreased ($n = 41$, 2.1%) for other core vaccines.

In addition, participants were asked how frequently dog ($n = 1937$) and cat ($n = 1982$) vaccine hesitant or resistant owners referenced the human medicine anti-vaxx movement. Participants reported that 1186 (61.2%) of dog owners never/rarely mention the movement, 209 (10.8%) mention it often/very often, 513 (26.5%) sometimes mention it, and 29 (1.5%) reported it as not applicable. For cat owners, par-

ticipants reported that the majority never/rarely 1277 (64.4%) mentioned the movement, often/very often (189, 9.5%), sometimes (489, 24.7%), and not applicable (27, 1.4%).

Participants were asked if there was an organized anti-vaxx movement opposed to mandatory vaccination for children in their community ($N = 2158$), to which 357 (16.5%) said yes, 580 (26.9%) said no, and 1221 (56.6%) said they did not know. For those who said yes ($n = 356$ with 1 missing), they were asked how prevalent they felt the child-related anti-vaxx sentiments are in their community, to which 72 (20.2%) said a great deal, 258 (72.5%) said some, 14 (3.9%) said none/minimal, and 12 (3.4%) said they don't know. Veterinarians also responded to the question of whether they felt that the anti-vaxx movement pertaining to mandatory vaccination in children has impacted clients' feelings or behaviors about vaccinating their dogs or cats. In reference to changes in dog owners ($N = 2123$), 1420 (66.9%) reported yes, 254 (12.0%) reported no, 135 (6.4%) said they had not thought about it, and 314 (14.8%) reported they did not know. For cat owners ($N = 2155$), 1380 (64.0%) respondents said yes, 301 (14.0%) said no, 131 (6.1%) said they had not thought about it, and 343 (15.9%) said they did not know.

For both dogs and cats, except for refusing rabies vaccines, respondents indicated feeling that the anti-vaxx movement pertaining to mandatory vaccination in children has resulted in an increase in the number of owners declining or expressing concern about rabies and core vaccinations. Owners declining rabies vaccination were reported to be increased ($n = 736$, 41.0%), stayed the same ($n = 993$, 55.4%), or decreased ($n = 64$, 3.6%) and those expressing concerns about rabies vaccination increased ($n = 944$, 50.4%), stayed the same ($n = 881$, 47.0%) or decreased ($n = 48$, 2.6%). Owners appeared to be more worried about other core vaccines, with the number of owners declining other core vaccines being increased ($n = 1142$, 61.6%), stayed the same ($n = 672$, 36.2%), or decreased ($n = 41$, 2.2%). Owners expressing concern about other core vaccines, however, had increased ($n = 1214$, 64.1%), stayed the same ($n = 650$, 34.3%), or decreased ($n = 31$, 1.6%).

Chi-square analyses were conducted to assess correlations between whether participants reported having had vaccine hesitant or resistant clients and whether their community has an organized anti-vaxx movement against mandatory vaccination for children. There was a positive correlation between the reported presence of a local organized anti-vaxx movement and participants' report of vaccine hesitant or resistant dog and cat owning clients. Resistance to vaccinating dogs for rabies ($n = 1968$); ($\chi^2 = 37.33$, $df = 2$, $P < 0.001$) and cats ($n = 1995$); ($\chi^2 = 42.97$, $df = 2$, $P < 0.001$) and resistance to vaccinating dogs with other core vaccines ($n = 2108$); ($\chi^2 = 13.52$, $df = 2$, $P = 0.001$) and cats ($n = 2139$); ($\chi^2 = 16.07$, $df = 2$, $P < 0.001$) were positively associated with the presence of an organized anti-vaxx movement against mandatory vaccination for children in the community. Similarly, there was a positive correlation between the trend (increase, decrease, or stay the same) of vaccine hesitant or resistant dog and cat owning clients and whether their community had an organized anti-vaxx movement against mandatory vaccination for children. The correlation results were

as follows: rabies vaccinations in dogs ($n = 1527$); ($\chi^2 = 12.07$, $df = 4$, $P = 0.017$); rabies vaccination in cats ($n = 1684$); ($\chi^2 = 20.94$, $df = 4$, $P < 0.001$); other core vaccinations in dogs ($n = 1918$); ($\chi^2 = 21.07$, $df = 4$, $P < 0.001$); other core vaccinations in cats ($n = 1936$); ($\chi^2 = 26.00$, $df = 4$, $P < 0.001$).

Participants were asked how successful they feel they are in changing the minds of vaccine hesitant or resistant clients. While veterinarians reported they were often successful in changing the minds of dog and cat owners pertaining to rabies vaccines (dogs: 63.3%, cats: 57.3%), they were less successful for other core vaccines (dogs: 37.2%, cats: 29.6%).

Discussion

In this study, veterinarians' concerns regarding vaccinating a healthy dog or cat were explored and compared to their clients' most commonly expressed concerns, with minimal overlap. Veterinarians' top vaccination-related concerns involve medical issues: anaphylaxis (dogs), vaccine-associated sarcoma (cats), soreness at injection site for several days (dogs and cats), and lethargy for several days after vaccination (dogs and cats). In contrast, dog and cat owners' concerns focused more on beliefs related to vaccines including cost, and that they are unnecessary or can lead to chronic or severe illness. These reported owner concerns were similar to those from a recent United Kingdom study in which the primary reasons given by dog owners for not vaccinating their dog included feeling it wasn't necessary (20%), too expensive (19%), or had not thought about it (11%) (13). Similarly, 21% of cat owners reluctant to vaccinate said vaccines were too expensive, 19% said that their cat does not encounter other animals, and 18% felt that vaccinations are unnecessary (13).

It is estimated that vaccines save between 2 and 6 million human lives each year (14) and have numerous other medical and nonmedical benefits. Vaccines can help counter antimicrobial resistance by preventing bacterial diseases and reducing antibiotic use. Vaccines have a positive economic impact by lowering healthcare costs associated with treating vaccine-preventable diseases and mitigating the impact of vaccine-preventable diseases on work productivity (15–17). Yet, there is a substantial number of vaccine hesitant people. The 2019 Wellcome Trust Global Monitor study reported that 79% of people worldwide feel that vaccines are safe, yet this rate is lower in high-income countries (e.g., 72% in Northern America), creating pockets of vaccine-preventable disease outbreaks (18,19).

The positive association in the current study between the reported presence of a local anti-vaxx movement and increased numbers of vaccine hesitant or resistant clients supported the hypothesis voiced by many; namely that the human anti-vaxx movement is impacting veterinary vaccination compliance. Unfortunately, while veterinarians indicate some success at changing the minds of clients resistant to obtaining rabies vaccinations, they are less successful with core vaccines. Perhaps this is due in part to negative social media messages about vaccines.

Misleading or biased social media messages can lead to erroneous heuristics, thereby fostering vaccine hesitancy or resistance (8,20). Unfortunately, people tend to cling to pre-established beliefs and are often resistant to new information

that can change these beliefs. This is especially true for individuals who believe that the views they hear reflect a larger group (21). Yet, a recent survey by the Royal Society for Public Health reported that 92% of respondents thought doctors and nurses were valued sources of information about vaccines (22). This is encouraging news, especially since veterinarians are one of the most trusted professionals (23). A recent UK study reported that 94% of respondents had high trust levels for veterinarians and there were similar results in a Canadian survey, with 87% of respondents reporting a positive view of veterinarians (24).

The positive feelings towards veterinarians suggest that they can have a crucial role in communicating with pet owners the benefits of vaccines, similar to human health care providers talking to parents about vaccinating their children (25). Specific techniques suggested to health care providers regarding vaccine education include using several types of communication channels including interpersonal, community-based, and mass/social media (8). Although social media can certainly have a role in message delivery, interpersonal communication (i.e., just talking with clients) was highly effective in persuasion (26). Furthermore, when discussing vaccine hesitancy or resistance with clients, it can be helpful to realize that, in addition to potential exposure to incorrect information, individual client traits such as reactance level may have a role in their decision-making process. People with high levels of reactance tend to be resistant to messages perceived as threatening their personal freedom (27,28). For this reason, it is suggested that vaccine discussions with hesitant or resistant clients should be individually tailored based on the unique perspective and needs of each client.

Limitations of this study are those inherent in an online survey and the fact that the survey was administered to VIN members and not the entire population of veterinarians. Although the authors carefully constructed the survey to minimize respondent bias to any question, potential participant bias is a noted limitation. To address this concern, the correlation between vaccination rates and local anti-vaxx activities was assessed in 2 ways. Several questions were factually based: trends in the actual number of clients expressing concern or refusing core or rabies vaccines for their dogs or cats and anti-vaxx activities on a local level. Other questions related to participants' perceptions. These perceptions have the potential to be biased, yet they are a critical component in understanding the full picture of how the anti-vaxx movement is perceived by practitioners to impact veterinary medicine. Together, the answers to both these types of questions suggest that the anti-vaxx movement has had an important impact on veterinary medicine.

In summary, vaccine hesitancy has been identified as a major health risk as we move into more uncertain times. The recent worldwide challenge of the SARS-CoV-2 virus is a vivid example (29). Although, at this time numerous scientists are working on a vaccine, the number of people who might be willing to take such a vaccine has been questioned.

This study was designed to assess the impact of local anti-vaxx movements on core vaccines and excluded questions regarding non-core vaccines. It was felt that it would be easier to assess

resistance to vaccination for diseases in which vaccines are either strongly suggested or required. The focus on core vaccines may have introduced bias into the results. Additionally, it is likely that veterinarians who are affected by, or have strong opinions about, anti-vaxx sentiments are more likely to complete the survey. We relied on the veterinarians who responded to the survey to understand local laws regarding rabies vaccination and did not verify what the laws are in each jurisdiction. It is possible that not all perceptions of the local rabies laws were accurate. A follow-up study to assess the trend in anti-vaxx sentiments, especially under the recent backdrop of COVID-19, would be of value.

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Erratum

Hair Loss in Guinea Pigs

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In the Veterinary Dermatology article on hair loss in guinea pigs published in the January 2021 issue of *The Canadian Veterinary Journal*, the unit of measurement used in reference to the louse *Gliricicola porcelli* should have been mm rather than μm .